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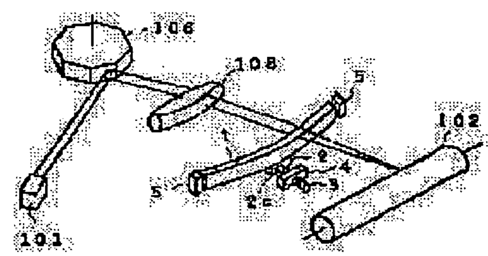
(54) OPTICAL SCANNING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To correct the warp of a long plastic lens constituting the optical system of a laser beam printer and to execute highly precise writing.
SOLUTION: A protruding part 2 receiving external force is provided at one end part (upper/lower ends) in the auxiliary scanning direction of the center part in the longitudinal direction of the cylindrical lens 1. A control screw 8 is screwed on the base of an optical unit near the cylindrical lens 1 and the control screw 3 is advanced/receded. Appropriate external force is given to the cylindrical lens 1 and warp is corrected. Thus, warp peculiar to the long plastic lens 1 can be corrected at the time of incorporating the cylindrical lens 1 into the optical unit. Thus, the deterioration of a lens optical characteristic such as the bend of an image surface, which is generated by the warp of the lens 1 is reduced, the characteristic of the optical system can be held constant and the printing performance of the laser beam printer is stabilized.



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CLAIMS

[Claim(s)]
[Claim 1] Light-scanning equipment characterized by having a means to correct curvature of said plastic lens according to external force, in light-scanning equipment which scans light by which outgoing radiation was carried out from the light source on scanned data medium through a scan means equipped with optical system constituted including a plastic lens.
[Claim 2] Said means to set right is light-scanning equipment according to claim 1 characterized by giving external force to a concave side from a convex side of curvature of said plastic lens.
[Claim 3] Light-scanning equipment according to claim 1 characterized by establishing said means to set right in the direction of vertical scanning on both sides of said plastic lens, respectively.
[Claim 4] Light-scanning equipment according to claim 1 or 3 characterized by said means to set right consisting of a screw member supported by supporter formed in an optical unit which carries said plastic lens.
[Claim 5] Light-scanning equipment according to claim 1 or 3 characterized by said means to set right consisting of a piezo actuator supported by supporter formed in an optical unit which carries said plastic lens.
[Claim 6] Light-scanning equipment according to claim 5 characterized by having a means to make the condition hold after correcting curvature of said plastic lens with said piezo actuator.
[Claim 7] Light-scanning equipment according to claim 6 characterized by said means made to hold being the screw member supported by supporter formed in an optical unit which carries said plastic lens.
[Claim 8] Light-scanning equipment according to claim 6 characterized by said means made to hold consisting of an engagement means formed in an optical unit side which carries said plastic lens side and said plastic lens, respectively.
[Claim 9] Light-scanning equipment according to claim 5 to 7 characterized by having a control means which energization to said piezo actuator is controlled [control means] according to an amount of curvature detected by means to detect curvature of said plastic lens, and means to detect this curvature, and makes curvature of plastics RENSU correct.
[Claim 10] Light-scanning equipment according to claim 8 characterized by a means to detect said curvature consisting of a strain gage.
[Claim 11] Light-scanning equipment according to claim 1 to 5 characterized by a portion which receives external force given by said means to set right being fabricated by said main part of a plastic lens at one.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to light-scanning equipment equipped with the means which starts the light-scanning equipment which used the long lens made from plastics for optical system, especially corrects deformation of a long cylindrical lens (curvature).
[0002]
[Description of the Prior Art] The configuration of the laser beam printer currently used for drawing 10 and drawing 11 from the former is shown. The laser beam printer consists of scan optical system (drawing 10) for modulating and deflecting the laser beam by which outgoing radiation was carried out from the light source 101, and forming an optical pattern (latent image) on a photo conductor 102, and an image formation system (drawing 11) for hard-copy-izing the optical pattern formed on the photo conductor 102 using an electrophotography process by scan optical system (development).
[0003] an optical scan system -- the light source 101 -- gas laser -- or generally semiconductor laser is used. Moreover, generally as a modulator 103, the A/O modulator using an acoustooptics (A/O) element is used. An A/O modulator passes an ultrasonic wave in an A/O element, by synchronous change of the refractive index which this produced, makes the laser beam which carried out incidence diffract, and performs intensity modulation. The beam compressor 104 from which the diameter of an incident beam is extracted in order to take the high modulation rate by the A/O element is formed between the light source 101 and a modulator 103, and the beam expander 105 used in order to obtain a small image formation spot on a photo conductor 102 is arranged between a modulator 103 and a rotating polygon 106. Between the beam expander 105 and a rotating polygon 106, the collimator lens (cylindrical lens) 107 which changes into a collimated beam the emission beam by which outgoing radiation is carried out from the light source 101 is allotted, and a photo conductor 102 is scanned by the laser beam by said rotating polygon 106 as an optical deflector. In addition, a hologram may be used instead of a rotating polygon 106.
[0004] Since the rotating polygon 106 is carrying out fixed-speed rotation, the laser beam reflected from the rotating polygon 106 concerned is deflected with constant angular velocity. Then, while the image formation lens (Ftheta lens) 108 is formed between a photo conductor 102 and a rotating polygon 106 and carrying out image formation of the deflected laser beam into the 1 plane on the 102nd page of a photo conductor, it is made to change so that optical distortion may be given to the incident light of constant angular velocity and the 102nd page top of a photo conductor may be scanned at uniform velocity. Generally this is called ftheta property.
[0005] It is the two-layer structure which prepared the photoconductor layer on the conductive base material, the charge which the photo conductor 102 surface is beforehand charged in homogeneity by discharge of a positive corona (electrification machine) 109 etc. in the dark place, and resistance of the light pipe of a portion which light hit when the laser beam from a rotating polygon 106 was given to this fell, and had been charged flows to a ground, and the portion in which the charge remains in the surface of a photo conductor 102, and the portion which does not remain produce a photo conductor 102. Thus, a latent image is formed. The latent image formed on the photo conductor 102 is developed with the toner charged in plus or minus. A laser beam is irradiated through the image formation (Ftheta) lens 108 at the same time it discharges the insulating-layer

surface by corona discharge to a photo conductor 102, as shown in drawing 11 . Resistance of a photoconduction layer falls, the bright section which the laser beam irradiated becomes conductivity, and the charge of the insulating-layer surface and a rear face is decreased promptly. Although the umbra which a laser beam does not irradiate serves as about 0 potential by exposing the potential on the surface of an insulating layer to the alternating current corona discharge 110, the charge currently formed in the interface of an insulating layer and a photoconduction layer is held.

[0006] Thus, by primary electrification, a laser beam is irradiated and is exposed at the same time it discharges the insulating-layer surface by corona electric discharge, after forming an electrification layer in the interface of an insulating layer and a photoconduction layer. Next, the whole surface of a photo conductor 102 is uniformly exposed with the whole surface photographic filter 111, and, thereby, the surface potential of an umbra is increased. The latent image formed on the photo conductor 102 is developed with the toner of the development counter 112 charged in plus or minus. After a development production process, the toner image on a photo conductor 102 is imprinted with the imprint charger 115 electrostatic by the regular paper sent through the feed roller 114 from the sheet paper cassette 113, and turns into a permanent image stabilized according to the fixing production process by the fixing assembly 116. The imprinted regular paper is sent into a stacker 117. After an imprint production process, a photo conductor removes the residual toner which was not able to be imprinted according to the cleaning production process by the cleaner 118 and the cleaning blade 119, glares and discharges the electric discharge lamp 120, and equips a latent-image formation process with it again. In addition, since this electrophotography process itself is well-known, the explanation beyond this is omitted here.

[0007]

[Problem(s) to be Solved by the Invention] In the optical system of equipments, such as a printer which uses the electrophotography process constituted as mentioned above, and a copying machine, by the way, recently Although many plastic lenses are used for the lens which constitutes scan optical system in order to attain low cost-ization The lens manufactured with (for example, refer to JP,59-204001,A) and plastics is compared with glass. The cost of materials [cheap] While there are many advantages, such as excelling in a lightweight moldability, there are defects, such as being hard to acquire the homogeneity of the refractive index inside that many properties of a material tend to change with change of temperature and humidity or mold goods compared with glass.

[0008] On the other hand, to the optical system of products, such as a camera and laser beam printer equipment, installation of an aspheric lens is prosperous. Although carrying out the deviation scan of the laser beam on a photo conductor 102 like a photo conductor drum or a photo conductor belt is performed by the combination of the Ftheta lens 108 and a rotating polygon 106 from the former as mentioned above with laser beam printer equipment, the problem of the failure by the so-called field which scanning pitch nonuniformity produces is in one of the troubles when scanning a laser beam with the inclination of the reflector of a rotating polygon 106.

[0009] What is going to reduce the effect by the inclination error (failure by the field) of a rotating polygon as a method of solving it with combination (JP,48-49315,A) with the combination (JP,48-98844,A) of a cylinder lens and a toric lens, a toric lens, a cylinder lens, or a spherical lens etc. is known. That to which the radius of curvature of the direction of a field failure of Ftheta lens is changed according to the deviation direction as a lens which furthermore aimed at improvement in an optical property is also known. This reduces aberration by making the configuration of Ftheta lens into a non-axial symmetry aspheric surface configuration so that it may become large as the radius of curvature of the direction of a field failure (the direction of vertical scanning) separates from an optical axis.

[0010] Although a non-axial symmetry aspheric surface Ftheta lens is a lens excellent in the optical property, when plastics is chosen as the lens quality of the material, an optical property may change with the effects of the heterogeneity of temperature and humidity or a refractive index. Therefore, the method of reducing the effect of temperature and humidity and refractive-index heterogeneity is effective by using combining a non-axial symmetry aspheric surface plastics Ftheta lens and a long plastics cylindrical lens, and making an optical scale factor small.

[0011] By the way, when performing lens shaping by the injection-molding method, since lens length is long, as shown in drawing 6 , curvature deformation may produce a cylindrical lens in the

lens longitudinal direction center section. By a diagram, delta shows the amount of curvatures (the amount of distortion). Thus, if "curvature" arises, since the radius of curvature of the longitudinal direction (main scanning direction) of a lens will change with curvature deformation, the image formation location of a lens is changed. That is, it becomes a technical technical problem required in order to realize a low price and highly efficient scan optical system to reduce curvature deformation of a cylindrical lens.

[0012] This invention was made in view of such a technical technical problem, and the purpose corrects curvature deformation of the cylindrical lens fabricated by the long configuration, and is to offer the light-scanning equipment in which highly precise writing is possible.

[0013]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in case a height is prepared in a cylindrical-lens longitudinal direction center section and a lens is built into an optical unit, curvature deformation of a lens is reduced by pushing a height on curvature and an opposite direction. A means to push a height forms a screw near the height as simplest method, is made to transform a lens by forcing force of a screw, and corrects curvature. Namely, in case a cylindrical lens is included in an optical unit, a screw is pushed in in the direction which reduces curvature of a lens. In that case, it works supervising an image formation location of a laser beam, tuning is ended in a phase which arrived at a predetermined image formation location in the lens whole region, and a screw is fixed.

[0014] Moreover, deformation of the direction of a field failure of a lens is also reformable by pushing independently two vertical edges, a direction (the direction of vertical scanning), i.e., a lens, which intersects perpendicularly with a longitudinal direction of a lens, respectively.

[0015] That is, in order to attain the above-mentioned purpose, this invention is characterized by having a means to correct curvature of said plastic lens according to external force, in light-scanning equipment which scans light by which outgoing radiation was carried out from the light source on scanned data medium through a scan means equipped with optical system constituted including a plastic lens.

[0016] In this case, a means to set right is good to give external force to a concave side from a convex side of curvature of said plastic lens. Moreover, said means to set right may be established in the direction of vertical scanning on both sides of the main part section of the plastic lens concerned, respectively in the center section of the longitudinal direction of said plastic lens.

[0017] A screw member supported by supporter formed in an optical unit which carries said plastic lens as said means to set right, or a piezo actuator is applicable. After correcting curvature of said plastic lens with said piezo actuator in that case, a means to make the condition hold may be established. In addition, a screw member supported by supporter formed in an optical unit which carries said plastic lens as said means made to hold can be used. Moreover, the engagement section is prepared in an optical unit side which carries said plastic lens side and said plastic lens as said means made to hold, respectively, and both relative location can be made to hold uniformly. It is desirable that a field where it comes as an engagement means using a thing of combination of cross-section 3 square shape, for example, and force is added in that case is perpendicularly formed to a direction where force acts.

[0018] Furthermore, when said piezo actuator is used, it is also possible to establish a control means which energization to said piezo actuator is controlled [control means] according to an amount of curvature detected by means to detect curvature of said plastic lens, and means to detect this curvature, and makes curvature of plastics RENSU correct, and to correct curvature automatically. In this case, a strain gage can be used as a means to detect said curvature. Moreover, a portion which receives external force given by means to give said external force is good for said main part of a plastic lens to fabricate to one.

[0019] Here, an operation of the above-mentioned configuration is explained. Curvature occurs in the lens longitudinal direction center section in drawing 6 , and signs that a lens deformed so that it might have loose curvature in the direction of a main shaft are shown. This is almost equivalent to a case where a concentrated load worked in the center section of the both-ends supporting beam, and the greatest bending arises in the center section of the beam. Then, lens forcing force taken to correct curvature is calculable as follows. As shown in drawing 5 , on an actual lens, it has curvature which

exists in the direction of vertical scanning (inside of drawing the 15mm length direction), but since it is easy here, a cross-section configuration of a lens is made into a rectangle configuration. As each size of a lens is shown in drawing, when lens length:300mm lens width-of-face:15mm lens thickness:5mm, a second moment of area is I=1.5x0.53/3=0.063cm4. It becomes. If a bending elastic modulus of plastic material is made into E= 24000kg/cm2 here, flexural rigidity EI of a lens will serve as EI=24000x0.063=1512 kg-cm2. The amount y of bending of a beam in a load point as shown in drawing 7 , when a concentrated load W acts in the center of a beam of length L y=WL3 / 48EI ... (1)

It becomes. Therefore, (1) type W=48 EIy/L3 ... (2)

It can deform.

[0020] That is, if (2) types are used, it can ask for magnitude of lens forcing force taken to amend curvature deformation which has the magnitude of y in the lens center section. In the case of a lens shown in drawing 6 , the amount [in / flexural rigidity / of a lens / by the above-mentioned count / in EI=1512 kg-cm2 and lens length / L= 300mm = 30cm and a lens center section] of curvatures is 350 micrometers [a maximum of] = 0.035cm. Therefore, magnitude of the lens forcing force W which lens curvature deformation amendment takes is set to W= 48x1512x0.035 / 303= 0.094kg from the above-mentioned (2) formula.

[0021] This is giving 94g forcing force to a lens center section, and shows that lens deformation by curvature produced at the time of shaping is reformable. Therefore, it is possible to fully correct lens deformation also by forcing force of a small screw like a screw.

[0022]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to details based on a drawing. In addition, in the following explanation, the same reference mark is given to each part equivalent to the above-mentioned conventional example, and the overlapping explanation is omitted suitably.

[0023] [1st operation gestalt] The lens configuration applied to the 1st operation gestalt at drawing 5 is shown. This lens is a lens with which the lens width of face of 300mm and the direction of vertical scanning has [length / the radius of curvature of 15mm and the direction of vertical scanning / the radius of curvature of 100mm and a main scanning direction] the cylindrical configuration which is infinity as mentioned above. Acrylic synthetic resin is used for the lens material, and it fabricated using the injection molding machine. The main process conditions are injection-speed 10 mm/s, 500kg/cm2 [of dwelling], and dwelling time 10 seconds for the maximum injection pressure of 850kg/cm2, and injection time amount 20 seconds. As a result of measuring the amount of curvatures of the fabricated lens, 0.35mm (=delta) curvature had occurred in the lens center section. delta= 0.35mm of this curvature is maximum as drawing 6 also shows. Thus, it becomes having the radius of curvature of a certain magnitude in the main scanning direction of a cylindrical lens, and equivalence to have generated 0.35mm curvature in the lens center section. In this case, the magnitude of said 0.35mm curvature is equivalent to 32143mm with the radius of curvature of a main scanning direction.

[0024] When the lens was built into the optical unit in the condition of not correcting curvature for the cylindrical lens which 0.35mm curvature produced, in the direction of vertical scanning, the 0.15mm curvature of field occurred to lens both ends, and occurred in the lens center section in 0.2mm and a main scanning direction. Then, the curvature of a lens was corrected and it carried out to reducing a curvature of field.

[0025] The curvature deformation amendment device of the cylindrical lens 1 which starts this operation gestalt at drawing 1 and drawing 2 is shown. With this operation gestalt, the SHIRIDORI cull lens 1 is formed between the Ftheta lens 108 and the photo conductor 102. A height 2 can be formed in a cylindrical lens 1 at one at the lower part of a center section, and surface 2a by the side of the convex of the height 2 can be pushed now with an adjusting screw 3. An adjusting screw 3 is screwed in the supporter 4 formed in the main part side of equipment (base side of a main part of an optical unit), and is prepared possible [an advance back space]. A cylindrical lens 1 will include both ends in the lens hold section 5 installed in both sides, will fix a location, and will push said height 2 with said adjusting screw 3.

[0026] That is, since some curvature deformation is in a cylindrical lens 1 as shown in drawing 1 ,

the curvature of field has arisen as above-mentioned. Then, an adjusting screw 3 is turned, a tip is made to contact surface 2c and it turns further, and a height 2 is turned to them until a curvature of field is lost to curvature and an opposite direction, as shown in push and drawing 2 . The existence of this curvature of field is judged with the image formation location as for which image formation is carried out by the cylindrical lens 1. That is, an image formation location is observed making a laser beam condense, after drawing 1 has curved, investigating an image formation location, and turning an adjusting screw 3, and it judges by whether the predetermined image formation location was arrived at as mentioned above in the lens whole region, and adjustment is ended when it reaches. If adjustment is completed, a stretching screw 3 is fixed by adhesives 4a so that a stretching screw 3 may not loosen. Besides fixing by adhesives 4a as a fixed means, a nut is used and it can fix. In addition, a height 2 may be used as another components instead of really fabricating, and may be attached in lens 1 main part after main part shaping of a cylindrical lens 1.

[0027] Again. The lock device for fixing a lens 1 in an amendment location may lens 1 main part and really be fabricated after amending curvature deformation of a cylindrical lens 1. This example is shown in drawing 3 . In this example, the height 6 which carries out amendment adjustment of the curvature deformation of a lens was formed in the pars basilaris ossis occipitalis of the center of a longitudinal direction of a lens 1, and the pawl 7 for fixing a lens 1 to this height 6 further in a deformation amendment location is formed. With this operation gestalt, as shown in drawing 3 , the right-triangle configuration which has one side perpendicular to a lens base is carried out, these pawls 7 and the gearing pawl 9 were formed in the base 8 side, and the cross-section configuration of this pawl 7 for lens immobilization has prevented the location gap.

[0028] The condition of the amount of curvatures of field in the curvature deformation amendment order of a lens is shown in a table 1.

[0029]

[A table 1]

表1 像面湾曲量 (mm)

	副走査方向			主走査方向		
	左端	中央	右端	左端	中央	右端
補正前	0.2	-0.03	0.2	-0.02	0.15	-0.02
補正後	0	0	0	0	0	0

[0030] In order to amend curvature deformation of a cylindrical lens 1 until a curvature of field is lost as shown in the above-mentioned table, the curvature of field of after lens deformation amendment is lost with the natural thing. In addition, what is numerically shown before amendment and as after amendment is what showed the amount of gaps from a focal location by mm, (-) expresses a gap of a near side and (+) expresses the gap by the side of the back.

[0031] In addition, correction of such curvature (distortion) of a cylindrical lens 1 is effective in especially the improvement in the image quality of a high definition laser beam printer, and there is a great effect also in prevention of a color gap of a full color laser beam printer.

[0032] [2nd operation gestalt] This operation gestalt is an example which reduces the field failure error of the lens produced in case a cylindrical lens is included in an optical unit.

[0033] When 0.5 degrees of field failure errors of a cylindrical lens 1 arise, in this optical system, it crosses to the range of the lens whole region in the direction of vertical scanning, and an image formation location shifts about 1.3mm. a gap of an image formation location -- the inside of the scanning zone of light -- it is -- about -- the magnitude of the diameter of a laser beam which condensed on the photoconductor drum (photo conductor 102) since it had shifted to Mr. one -- about -- it is set to Mr. one. However, since the magnitude of the diameter of a laser beam which only the part from which the image formation location shifted condensed becomes larger than a layout value, when it is going to obtain the printing result of high resolution as a laser beam printer, it is necessary to reduce a gap of an image formation location. So, with this operation gestalt, height

2a and 2b are prepared in the vertical edge (the direction of vertical scanning) of a cylindrical lens 1. The tip of the adjusting screws 3a and 3b screwed in the susceptors 4a and 4b which protruded on the surfaces 2d and 2e by the side of each convex at the bases 8a and 8b of the bottom and a top is made to contact, and the stroke of adjusting screws 3a and 3b is changed, respectively, it adjusts independently, and field failure amendment of a cylindrical lens 1 is performed. For example, if 130 micrometers of height 2bs currently attached to lens upper limit are pushed using adjusting-screw 3b since 130 micrometers of upper limit of a lens have shifted from the original setting location when 0.5 degrees of lenses incline and it is equipped with them like drawing 4 , a field failure error will be canceled.

[0034] All of others, especially each part which is not explained are constituted by the above-mentioned conventional example, and the 1st operation gestalt and EQC.

[0035] In addition, although he is trying to reduce the field failure error of a lens with this operation gestalt, the field failure error produced with the inclination of the axis of rotation of a rotating polygon 106 can also adjust easily the detailed error which cannot be amended only by optical system by adjustment of the axis of rotation of a rotating polygon 106.

[0036] [3rd operation gestalt] This operation gestalt is an example which corrects the curvature of a cylindrical lens electrically.

[0037] Drawing 8 is control-block drawing for correcting deformation of a lens automatically, and drawing 9 is the perspective diagram of the cylinder lens set as the object of correction. In this example, while forming a height 2 in the lower part of the cylinder lens 1, a strain gage 10 is stuck on the field by the side of the photo conductor 102 of the SHIRIDORI cull lens 1 as a detector. Moreover, the actuation side of the piezo actuator 11 is made to contact field 2c by the side of the convex of said height 2. The detection output of a strain gage (detector) 10 is inputted into the processing circuit 12 of servo system as shown in drawing 8 , operates the piezo actuator 11 with the directions output from this processing circuit 12, and changes the curvature of a cylindrical lens 1 by pressing said field 2c in respect of actuation of the actuator 11 concerned. this curvature -- in other words, the deformation 13 of a lens is supervised by real time by the strain gage 10, and amendment of an initial complement is performed automatically. In addition, if the relation of the output of curvature (the amount of distortion) and a strain gage 10 performs a calibration beforehand and both relation is stored in said processor 12, amendment of the curvature of the cylinder lens 1 can be performed to the timing of arbitration. In addition, when not performing light scanning, the energization to the piezo actuator 11 will also be severed and the cylinder lens 1 will return to the original deformation condition with own elasticity. Others, especially each part which is not explained are constituted by the above-mentioned conventional example, the 1st operation gestalt and the 2nd operation gestalt, and the EQC.

[0038] With this operation gestalt, the piezo actuator 11 can also perform field failure amendment like the 2nd operation gestalt with the piezo actuator 11 of the direction of vertical scanning of a cylindrical lens 1 which prepared the lobe up and down and was formed separately, respectively, although one-piece ** is not prepared. Moreover, it is also possible to form the piezo actuator 11 in one pair so that said lobe 2 may be inserted, and to correct distortion of a cylindrical lens 1.

[0039] In addition, it constitutes from this operation gestalt so that the control current may be passed to the piezo actuator 11 and the deformation of the piezo actuator 11 may be held uniformly, but when curvature (distortion delta) is set to 0 combining the stretching screw in the 1st operation gestalt, it can also constitute so that a cylindrical lens 1 may be pressed down with an adjusting screw. In this case, curvature (distortion) can be corrected automatically, without supervising an image formation location as mentioned above.

[0040] Moreover, although the strain gage is used for detection of the amount of distortion of a cylindrical lens 1 with this operation gestalt, it is also possible, and for electrostatic capacity to detect or to use a laser displacement gage. [using the eddy current]

[0041]

[Effect of the Invention] As mentioned above, according to this invention, effect is taken as follows.

[0042] Since the light-scanning equipment incorporating a plastic lens is equipped with a means to correct curvature according to invention [equipped with a means to correct the curvature of a plastic lens according to external force] according to claim 1, after incorporating a plastic lens, it becomes

possible to correct curvature and the accurate writing of it is attained with a cheap plastic lens.
[0043] According to invention according to claim 2 whose a means to set right gave external force to the concave side from the convex side of the curvature of a plastic lens, curvature is reformable only by the device which presses a plastic lens from a convex side.
[0044] Since it becomes possible to adjust the inclination of the direction of vertical scanning of a plastic lens according to invention according to claim 3 in which a means to give external force was formed in the direction of vertical scanning on both sides of the plastic lens, respectively, field failure amendment can perform easily and highly precise writing is attained.
[0045] According to invention according to claim 4 which a means to give external force becomes from the screw member supported by the supporter formed in the optical unit which carries said plastic lens, by turning a screw member, the curvature of a plastic lens can be corrected easily and highly precise writing is attained by low cost.
[0046] According to invention according to claim 5 which consists of a piezo actuator supported by the supporter formed in the optical unit which carries said plastic lens, a means to give external force becomes reformable [the curvature of a plastic lens] by electric actuation.
[0047] After correcting the curvature of said plastic lens with a piezo actuator, according to invention [equipped with a means to make the condition hold] according to claim 6, it adjusts electrically only at the time of adjustment, and tuning becomes easy by holding mechanically.
[0048] According to invention according to claim 8 which consists of an engagement means to by_which the means according to claim 7 which consists of a screw member supported by the supporter with which the means made to hold was formed in the optical unit which carries said plastic lens, and which is made to invent and hold was formed in the optical unit side which carries said plastic lens side and said plastic lens, respectively, the condition corrected curvature with the easy mechanical configuration can be held.
[0049] According to invention [equipped with the control means which the energization to said piezo actuator is controlled / control means / according to the amount of the curvature detected by means to detect the curvature of a plastic lens, and means to detect this curvature, and makes the curvature of plastics RENSU correct] according to claim 9, the curvature of a plastic lens can be corrected automatically and tuning can be performed very easily.
[0050] According to invention according to claim 10 which a means to detect curvature becomes from a strain gage, the curvature of a plastic lens is certainly detectable by the cheap detecting element.
[0051] Curvature can be corrected without degrading the optical engine performance of a plastic lens according to the external force which joins a plastic lens side according to invention according to claim 11 characterized by the portion which receives the external force given by means to give external force being fabricated by said main part of a plastic lens at one.

[Translation done.]

TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to light-scanning equipment equipped with the means which starts the light-scanning equipment which used the long lens made from plastics for optical system, especially corrects deformation of a long cylindrical lens (curvature).

[Translation done.]

PRIOR ART

[Description of the Prior Art] The configuration of the laser beam printer currently used for drawing 10 and drawing 11 from the former is shown. The laser beam printer consists of scan optical system (drawing 10) for modulating and deflecting the laser beam by which outgoing radiation was carried out from the light source 101, and forming an optical pattern (latent image) on a photo conductor 102, and an image formation system (drawing 11) for hard-copy-izing the optical pattern formed on the photo conductor 102 using an electrophotography process by scan optical system (development).
[0003] an optical scan system -- the light source 101 -- gas laser -- or generally semiconductor laser is used. Moreover, generally as a modulator 103, the A/O modulator using an acoustooptics (A/O) element is used. An A/O modulator passes an ultrasonic wave in an A/O element, by synchronous change of the refractive index which this produced, makes the laser beam which carried out incidence diffract, and performs intensity modulation. The beam compressor 104 from which the diameter of an incident beam is extracted in order to take the high modulation rate by the A/O element is formed between the light source 101 and a modulator 103, and the beam expander 105 used in order to obtain a small image formation spot on a photo conductor 102 is arranged between a modulator 103 and a rotating polygon 106. Between the beam expander 105 and a rotating polygon 106, the collimator lens (cylindrical lens) 107 which changes into a collimated beam the emission beam by which outgoing radiation is carried out from the light source 101 is allotted, and a photo conductor 102 is scanned by the laser beam by said rotating polygon 106 as an optical deflector. In addition, a hologram may be used instead of a rotating polygon 106.
[0004] Since the rotating polygon 106 is carrying out fixed-speed rotation, the laser beam reflected from the rotating polygon 106 concerned is deflected with constant angular velocity. Then, while the image formation lens (Ftheta lens) 108 is formed between a photo conductor 102 and a rotating polygon 106 and carrying out image formation of the deflected laser beam into the 1 plane on the 102nd page of a photo conductor, it is made to change so that optical distortion may be given to the incident light of constant angular velocity and the 102nd page top of a photo conductor may be scanned at uniform velocity. Generally this is called ftheta property.
[0005] It is the two-layer structure which prepared the photoconductor layer on the conductive base material, the charge which the photo conductor 102 surface is beforehand charged in homogeneity by discharge of a positive corona (electrification machine) 109 etc. in the dark place, and resistance of the light pipe of a portion which light hit when the laser beam from a rotating polygon 106 was given to this fell, and had been charged flows to a ground, and the portion in which the charge remains in the surface of a photo conductor 102, and the portion which does not remain produce a photo conductor 102. Thus, a latent image is formed. The latent image formed on the photo conductor 102 is developed with the toner charged in plus or minus. A laser beam is irradiated through the image formation (Ftheta) lens 108 at the same time it discharges the insulating-layer surface by corona discharge to a photo conductor 102, as shown in drawing 11 . Resistance of a photoconduction layer falls, the bright section which the laser beam irradiated becomes conductivity, and the charge of the insulating-layer surface and a rear face is decreased promptly. Although the umbra which a laser beam does not irradiate serves as about 0 potential by exposing the potential on the surface of an insulating layer to the alternating current corona discharge 110, the charge currently formed in the interface of an insulating layer and a photoconduction layer is held.
[0006] Thus, by primary electrification, a laser beam is irradiated and is exposed at the same time it

discharges the insulating-layer surface by corona electric discharge, after forming an electrification layer in the interface of an insulating layer and a photoconduction layer. Next, the whole surface of a photo conductor 102 is uniformly exposed with the whole surface photographic filter 111, and, thereby, the surface potential of an umbra is increased. The latent image formed on the photo conductor 102 is developed with the toner of the development counter 112 charged in plus or minus. After a development production process, the toner image on a photo conductor 102 is imprinted with the imprint charger 115 electrostatic by the regular paper sent through the feed roller 114 from the sheet paper cassette 113, and turns into a permanent image stabilized according to the fixing production process by the fixing assembly 116. The imprinted regular paper is sent into a stacker 117. After an imprint production process, a photo conductor removes the residual toner which was not able to be imprinted according to the cleaning production process by the cleaner 118 and the cleaning blade 119, glares and discharges the electric discharge lamp 120, and equips a latent-image formation process with it again. In addition, since this electrophotography process itself is well-known, the explanation beyond this is omitted here.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, according to this invention, effect is taken as follows.
[0042] Since the light-scanning equipment incorporating a plastic lens is equipped with a means to correct curvature according to invention [equipped with a means to correct the curvature of a plastic lens according to external force] according to claim 1, after incorporating a plastic lens, it becomes possible to correct curvature and the accurate writing of it is attained with a cheap plastic lens.
[0043] According to invention according to claim 2 whose a means to set right gave external force to the concave side from the convex side of the curvature of a plastic lens, curvature is reformable only by the device which presses a plastic lens from a convex side.
[0044] Since it becomes possible to adjust the inclination of the direction of vertical scanning of a plastic lens according to invention according to claim 3 in which a means to give external force was formed in the direction of vertical scanning on both sides of the plastic lens, respectively, field failure amendment can perform easily and highly precise writing is attained.
[0045] According to invention according to claim 4 which a means to give external force becomes from the screw member supported by the supporter formed in the optical unit which carries said plastic lens, by turning a screw member, the curvature of a plastic lens can be corrected easily and highly precise writing is attained by low cost.
[0046] According to invention according to claim 5 which consists of a piezo actuator supported by the supporter formed in the optical unit which carries said plastic lens, a means to give external force becomes reformable [the curvature of a plastic lens] by electric actuation.
[0047] After correcting the curvature of said plastic lens with a piezo actuator, according to invention [equipped with a means to make the condition hold] according to claim 6, it adjusts electrically only at the time of adjustment, and tuning becomes easy by holding mechanically.
[0048] According to invention according to claim 8 which consists of an engagement means to by_which the means according to claim 7 which consists of a screw member supported by the supporter with which the means made to hold was formed in the optical unit which carries said plastic lens, and which is made to invent and hold was formed in the optical unit side which carries said plastic lens side and said plastic lens, respectively, the condition corrected curvature with the easy mechanical configuration can be held.
[0049] According to invention [equipped with the control means which the energization to said piezo actuator is controlled / control means / according to the amount of the curvature detected by means to detect the curvature of a plastic lens, and means to detect this curvature, and makes the curvature of plastics RENSU correct] according to claim 9, the curvature of a plastic lens can be corrected automatically and tuning can be performed very easily.
[0050] According to invention according to claim 10 which a means to detect curvature becomes from a strain gage, the curvature of a plastic lens is certainly detectable by the cheap detecting element.
[0051] Curvature can be corrected without degrading the optical engine performance of a plastic lens according to the external force which joins a plastic lens side according to invention according to claim 11 characterized by the portion which receives the external force given by

means to give external force being fabricated by said main part of a plastic lens at one.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the optical system of equipments, such as a printer which uses the electrophotography process constituted as mentioned above, and a copying machine, by the way, recently Although many plastic lenses are used for the lens which constitutes scan optical system in order to attain low cost-ization The lens manufactured with (for example, refer to JP,59-204001,A) and plastics is compared with glass. The cost of materials [cheap] While there are many advantages, such as excelling in a lightweight moldability, there are defects, such as being hard to acquire the homogeneity of the refractive index inside that many properties of a material tend to change with change of temperature and humidity or mold goods compared with glass.
[0008] On the other hand, to the optical system of products, such as a camera and laser beam printer equipment, installation of an aspheric lens is prosperous. Although carrying out the deviation scan of the laser beam on a photo conductor 102 like a photo conductor drum or a photo conductor belt is performed by the combination of the Ftheta lens 108 and a rotating polygon 106 from the former as mentioned above with laser beam printer equipment, the problem of the failure by the so-called field which scanning pitch nonuniformity produces is in one of the troubles when scanning a laser beam with the inclination of the reflector of a rotating polygon 106.
[0009] What is going to reduce the effect by the inclination error (failure by the field) of a rotating polygon as a method of solving it with combination (JP,48-49315,A) with the combination (JP,48-98844,A) of a cylinder lens and a toric lens, a toric lens, a cylinder lens, or a spherical lens etc. is known. That to which the radius of curvature of the direction of a field failure of Ftheta lens is changed according to the deviation direction as a lens which furthermore aimed at improvement in an optical property is also known. This reduces aberration by making the configuration of Ftheta lens into a non-axial symmetry aspheric surface configuration so that it may become large as the radius of curvature of the direction of a field failure (the direction of vertical scanning) separates from an optical axis.
[0010] Although a non-axial symmetry aspheric surface Ftheta lens is a lens excellent in the optical property, when plastics is chosen as the lens quality of the material, an optical property may change with the effects of the heterogeneity of temperature and humidity or a refractive index. Therefore, the method of reducing the effect of temperature and humidity and refractive-index heterogeneity is effective by using combining a non-axial symmetry aspheric surface plastics Ftheta lens and a long plastics cylindrical lens, and making an optical scale factor small.
[0011] By the way, when performing lens shaping by the injection-molding method, since lens length is long, as shown in drawing 6 , curvature deformation may produce a cylindrical lens in the lens longitudinal direction center section. By a diagram, delta shows the amount of curvatures (the amount of distortion). Thus, if "curvature" arises, since the radius of curvature of the longitudinal direction (main scanning direction) of a lens will change with curvature deformation, the image formation location of a lens is changed. That is, it becomes a technical technical problem required in order to realize a low price and highly efficient scan optical system to reduce curvature deformation of a cylindrical lens.
[0012] This invention was made in view of such a technical technical problem, and the purpose corrects curvature deformation of the cylindrical lens fabricated by the long configuration, and is to offer the light-scanning equipment in which highly precise writing is possible.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, in case a height is prepared in a cylindrical-lens longitudinal direction center section and a lens is built into an optical unit, curvature deformation of a lens is reduced by pushing a height on curvature and an opposite direction. A means to push a height forms a screw near the height as simplest method, is made to transform a lens by forcing force of a screw, and corrects curvature. Namely, in case a cylindrical lens is included in an optical unit, a screw is pushed in in the direction which reduces curvature of a lens. In that case, it works supervising an image formation location of a laser beam, tuning is ended in a phase which arrived at a predetermined image formation location in the lens whole region, and a screw is fixed.
[0014] Moreover, deformation of the direction of a field failure of a lens is also reformable by pushing independently two vertical edges, a direction (the direction of vertical scanning), i.e., a lens, which intersects perpendicularly with a longitudinal direction of a lens, respectively.
[0015] That is, in order to attain the above-mentioned purpose, this invention is characterized by having a means to correct curvature of said plastic lens according to external force, in light-scanning equipment which scans light by which outgoing radiation was carried out from the light source on scanned data medium through a scan means equipped with optical system constituted including a plastic lens.
[0016] In this case, a means to set right is good to give external force to a concave side from a convex side of curvature of said plastic lens. Moreover, said means to set right may be established in the direction of vertical scanning on both sides of the main part section of the plastic lens concerned, respectively in the center section of the longitudinal direction of said plastic lens.
[0017] A screw member supported by supporter formed in an optical unit which carries said plastic lens as said means to set right, or a piezo actuator is applicable. After correcting curvature of said plastic lens with said piezo actuator in that case, a means to make the condition hold may be established. In addition, a screw member supported by supporter formed in an optical unit which carries said plastic lens as said means made to hold can be used. Moreover, the engagement section is prepared in an optical unit side which carries said plastic lens side and said plastic lens as said means made to hold, respectively, and both relative location can be made to hold uniformly. It is desirable that a field where it comes as an engagement means using a thing of combination of cross-section 3 square shape, for example, and force is added in that case is perpendicularly formed to a direction where force acts.
[0018] Furthermore, when said piezo actuator is used, it is also possible to establish a control means which energization to said piezo actuator is controlled [control means] according to an amount of curvature detected by means to detect curvature of said plastic lens, and means to detect this curvature, and makes curvature of plastics RENSU correct, and to correct curvature automatically. In this case, a strain gage can be used as a means to detect said curvature. Moreover, a portion which receives external force given by means to give said external force is good for said main part of a plastic lens to fabricate to one.
[0019] Here, an operation of the above-mentioned configuration is explained. Curvature occurs in the lens longitudinal direction center section in drawing 6 , and signs that a lens deformed so that it might have loose curvature in the direction of a main shaft are shown. This is almost equivalent to a case where a concentrated load worked in the center section of the both-ends supporting beam, and

the greatest bending arises in the center section of the beam. Then, lens forcing force taken to correct curvature is calculable as follows. As shown in drawing 5 , on an actual lens, it has curvature which exists in the direction of vertical scanning (inside of drawing the 15mm length direction), but since it is easy here, a cross-section configuration of a lens is made into a rectangle configuration. As each size of a lens is shown in drawing, when lens length:300mm lens width-of-face:15mm lens thickness:5mm, a second moment of area is I=1.5x0.53/3=0.063cm4. It becomes. If a bending elastic modulus of plastic material is made into E= 24000kg/cm2 here, flexural rigidity EI of a lens will serve as EI=24000x0.063=1512 kg-cm2. The amount y of bending of a beam in a load point as shown in drawing 7 , when a concentrated load W acts in the center of a beam of length L y=WL3 / 48EI ... (1)
It becomes. Therefore, (1) type W=48 EIy/L3 ... (2)
It can deform.
[0020] That is, if (2) types are used, it can ask for magnitude of lens forcing force taken to amend curvature deformation which has the magnitude of y in the lens center section. In the case of a lens shown in drawing 6 , the amount [in / flexural rigidity / of a lens / by the above-mentioned count / in EI=1512 kg-cm2 and lens length / L= 300mm = 30cm and a lens center section] of curvatures is 350 micrometers [a maximum of] = 0.035cm. Therefore, magnitude of the lens forcing force W which lens curvature deformation amendment takes is set to W= 48x1512x0.035 / 303= 0.094kg from the above-mentioned (2) formula.
[0021] This is giving 94g forcing force to a lens center section, and shows that lens deformation by curvature produced at the time of shaping is reformable. Therefore, it is possible to fully correct lens deformation also by forcing force of a small screw like a screw.
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to details based on a drawing. In addition, in the following explanation, the same reference mark is given to each part equivalent to the above-mentioned conventional example, and the overlapping explanation is omitted suitably.
[0023] [1st operation gestalt] The lens configuration applied to the 1st operation gestalt at drawing 5 is shown. This lens is a lens with which the lens width of face of 300mm and the direction of vertical scanning has [length / the radius of curvature of 15mm and the direction of vertical scanning / the radius of curvature of 100mm and a main scanning direction] the cylindrical configuration which is infinity as mentioned above. Acrylic synthetic resin is used for the lens material, and it fabricated using the injection molding machine. The main process conditions are injection-speed 10 mm/s, 500kg/cm2 [of dwelling], and dwelling time 10 seconds for the maximum injection pressure of 850kg/cm2, and injection time amount 20 seconds. As a result of measuring the amount of curvatures of the fabricated lens, 0.35mm (=delta) curvature had occurred in the lens center section. delta= 0.35mm of this curvature is maximum as drawing 6 also shows. Thus, it becomes having the radius of curvature of a certain magnitude in the main scanning direction of a cylindrical lens, and equivalence to have generated 0.35mm curvature in the lens center section. In this case, the magnitude of said 0.35mm curvature is equivalent to 32143mm with the radius of curvature of a main scanning direction.
[0024] When the lens was built into the optical unit in the condition of not correcting curvature for the cylindrical lens which 0.35mm curvature produced, in the direction of vertical scanning, the 0.15mm curvature of field occurred to lens both ends, and occurred in the lens center section in 0.2mm and a main scanning direction. Then, the curvature of a lens was corrected and it carried out to reducing a curvature of field.
[0025] The curvature deformation amendment device of the cylindrical lens 1 which starts this operation gestalt at drawing 1 and drawing 2 is shown. With this operation gestalt, the SHIRIDORI cull lens 1 is formed between the Ftheta lens 108 and the photo conductor 102. A height 2 can be formed in a cylindrical lens 1 at one at the lower part of a center section, and surface 2a by the side of the convex of the height 2 can be pushed now with an adjusting screw 3. An adjusting screw 3 is screwed in the supporter 4 formed in the main part side of equipment (base side of a main part of an optical unit), and is prepared possible [an advance back space]. A cylindrical lens 1 will include both ends in the lens hold section 5 installed in both sides, will fix a location, and will push said

height 2 with said adjusting screw 3.

[0026] That is, since some curvature deformation is in a cylindrical lens 1 as shown in drawing 1, the curvature of field has arisen as above-mentioned. Then, an adjusting screw 3 is turned, a tip is made to contact surface 2c and it turns further, and a height 2 is turned to them until a curvature of field is lost to curvature and an opposite direction, as shown in push and drawing 2. The existence of this curvature of field is judged with the image formation location as for which image formation is carried out by the cylindrical lens 1. That is, an image formation location is observed making a laser beam condense, after drawing 1 has curved, investigating an image formation location, and turning an adjusting screw 3, and it judges by whether the predetermined image formation location was arrived at as mentioned above in the lens whole region, and adjustment is ended when it reaches. If adjustment is completed, a stretching screw 3 is fixed by adhesives 4a so that a stretching screw 3 may not loosen. Besides fixing by adhesives 4a as a fixed means, a nut is used and it can fix. In addition, a height 2 may be used as another components instead of really fabricating, and may be attached in lens 1 main part after main part shaping of a cylindrical lens 1.

[0027] Again. The lock device for fixing a lens 1 in an amendment location may lens 1 main part and really be fabricated after amending curvature deformation of a cylindrical lens 1. This example is shown in drawing 3. In this example, the height 6 which carries out amendment adjustment of the curvature deformation of a lens was formed in the pars basilaris ossis occipitalis of the center of a longitudinal direction of a lens 1, and the pawl 7 for fixing a lens 1 to this height 6 further in a deformation amendment location is formed. With this operation gestalt, as shown in drawing 3, the right-triangle configuration which has one side perpendicular to a lens base is carried out, these pawls 7 and the gearing pawl 9 were formed in the base 8 side, and the cross-section configuration of this pawl 7 for lens immobilization has prevented the location gap.

[0028] The condition of the amount of curvatures of field in the curvature deformation amendment order of a lens is shown in a table 1.

[0029]

[A table 1]

表1 像面湾曲量 (mm)

	副走査方向			主走査方向		
	左端	中央	右端	左端	中央	右端
補正前	0.2	-0.03	0.2	-0.02	0.15	-0.02
補正後	0	0	0	0	0	0

[0030] In order to amend curvature deformation of a cylindrical lens 1 until a curvature of field is lost as shown in the above-mentioned table, the curvature of field of after lens deformation amendment is lost with the natural thing. In addition, what is numerically shown before amendment and as after amendment is what showed the amount of gaps from a focal location by mm, (-) expresses a gap of a near side and (+) expresses the gap by the side of the back.

[0031] In addition, correction of such curvature (distortion) of a cylindrical lens 1 is effective in especially the improvement in the image quality of a high definition laser beam printer, and there is a great effect also in prevention of a color gap of a full color laser beam printer.

[0032] [2nd operation gestalt] This operation gestalt is an example which reduces the field failure error of the lens produced in case a cylindrical lens is included in an optical unit.

[0033] When 0.5 degrees of field failure errors of a cylindrical lens 1 arise, in this optical system, it crosses to the range of the lens whole region in the direction of vertical scanning, and an image formation location shifts about 1.3mm. a gap of an image formation location -- the inside of the scanning zone of light -- it is -- about -- the magnitude of the diameter of a laser beam which condensed on the photoconductor drum (photo conductor 102) since it had shifted to Mr. one -- about -- it is set to Mr. one. However, since the magnitude of the diameter of a laser beam which only the part from which the image formation location shifted condensed becomes larger than a

layout value, when it is going to obtain the printing result of high resolution as a laser beam printer, it is necessary to reduce a gap of an image formation location. So, with this operation gestalt, height 2a and 2b are prepared in the vertical edge (the direction of vertical scanning) of a cylindrical lens 1. The tip of the adjusting screws 3a and 3b screwed in the susceptors 4a and 4b which protruded on the surfaces 2d and 2e by the side of each convex at the bases 8a and 8b of the bottom and a top is made to contact, and the stroke of adjusting screws 3a and 3b is changed, respectively, it adjusts independently, and field failure amendment of a cylindrical lens 1 is performed. For example, if 130 micrometers of height 2bs currently attached to lens upper limit are pushed using adjusting-screw 3b since 130 micrometers of upper limit of a lens have shifted from the original setting location when 0.5 degrees of lenses incline and it is equipped with them like drawing 4 , a field failure error will be canceled.

[0034] All of others, especially each part which is not explained are constituted by the above-mentioned conventional example, and the 1st operation gestalt and EQC.

[0035] In addition, although he is trying to reduce the field failure error of a lens with this operation gestalt, the field failure error produced with the inclination of the axis of rotation of a rotating polygon 106 can also adjust easily the detailed error which cannot be amended only by optical system by adjustment of the axis of rotation of a rotating polygon 106.

[0036] [3rd operation gestalt] This operation gestalt is an example which corrects the curvature of a cylindrical lens electrically.

[0037] Drawing 8 is control-block drawing for correcting deformation of a lens automatically, and drawing 9 is the perspective diagram of the cylinder lens set as the object of correction. In this example, while forming a height 2 in the lower part of the cylinder lens 1, a strain gage 10 is stuck on the field by the side of the photo conductor 102 of the SHIRIDORI cull lens 1 as a detector. Moreover, the actuation side of the piezo actuator 11 is made to contact field 2c by the side of the convex of said height 2. The detection output of a strain gage (detector) 10 is inputted into the processing circuit 12 of servo system as shown in drawing 8 , operates the piezo actuator 11 with the directions output from this processing circuit 12, and changes the curvature of a cylindrical lens 1 by pressing said field 2c in respect of actuation of the actuator 11 concerned. this curvature -- in other words, the deformation 13 of a lens is supervised by real time by the strain gage 10, and amendment of an initial complement is performed automatically. In addition, if the relation of the output of curvature (the amount of distortion) and a strain gage 10 performs a calibration beforehand and both relation is stored in said processor 12, amendment of the curvature of the cylinder lens 1 can be performed to the timing of arbitration. In addition, when not performing light scanning, the energization to the piezo actuator 11 will also be severed and the cylinder lens 1 will return to the original deformation condition with own elasticity. Others, especially each part which is not explained are constituted by the above-mentioned conventional example, the 1st operation gestalt and the 2nd operation gestalt, and the EQC.

[0038] With this operation gestalt, the piezo actuator 11 can also perform field failure amendment like the 2nd operation gestalt with the piezo actuator 11 of the direction of vertical scanning of a cylindrical lens 1 which prepared the lobe up and down and was formed separately, respectively, although one-piece ** is not prepared. Moreover, it is also possible to form the piezo actuator 11 in one pair so that said lobe 2 may be inserted, and to correct distortion of a cylindrical lens 1.

[0039] In addition, it constitutes from this operation gestalt so that the control current may be passed to the piezo actuator 11 and the deformation of the piezo actuator 11 may be held uniformly, but when curvature (distortion delta) is set to 0 combining the stretching screw in the 1st operation gestalt, it can also constitute so that a cylindrical lens 1 may be pressed down with an adjusting screw. In this case, curvature (distortion) can be corrected automatically, without supervising an image formation location as mentioned above.

[0040] Moreover, although the strain gage is used for detection of the amount of distortion of a cylindrical lens 1 with this operation gestalt, it is also possible, and for electrostatic capacity to detect or to use a laser displacement gage. [using the eddy current]

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing the condition before correction of the optical system which has the curvature straightening machine style of the cylindrical lens concerning 1 operation gestalt of this invention.
[Drawing 2] It is the outline block diagram showing the condition after correction of the optical system of drawing 1 .
[Drawing 3] After correcting the curvature of a cylindrical lens, it is the schematic diagram showing the device in which the condition of having set right is held.
[Drawing 4] It is the schematic diagram showing the straightening machine style of the failure by the field of a cylindrical lens.
[Drawing 5] It is the perspective diagram showing the appearance and dimension of a cylindrical lens.
[Drawing 6] It is the plan showing the condition of deformation by the curvature of a cylindrical lens.
[Drawing 7] It is model drawing showing the condition of curvature deformation of a cylindrical lens.
[Drawing 8] It is control-block drawing for operating the straightening machine style of a cylindrical lens electrically.
[Drawing 9] It is the perspective diagram showing the example which corrects a cylindrical lens with a piezo actuator.
[Drawing 10] It is the outline block diagram showing the optical system of a common laser beam printer.
[Drawing 11] It is the outline block diagram showing the image formation system of a common laser beam printer.
[Description of Notations]
1 Cylindrical Lens
2, 2b, 2c Height
3, 3a, 3b Adjusting screw
4 Supporter
4a Adhesives
5 Hold Section
6 Height
7 Nine Pawl
8, 8a, 8b Base
9 Pawl
10 Strain Gage
11 Piezo Actuator
12 Processor
13 Lens Deformation
101 Light Source
102 Photo Conductor
106 Rotating Polygon

108 FTheta Lens

[Translation done.]

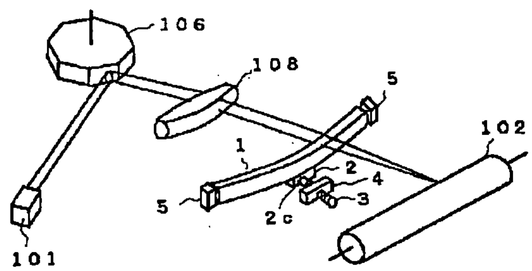
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

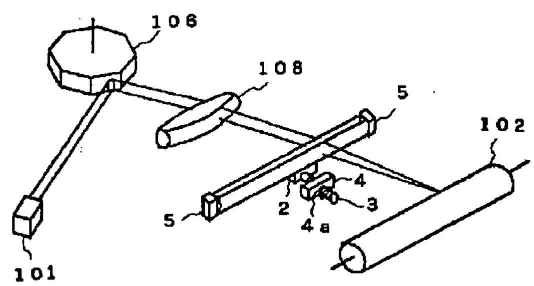
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

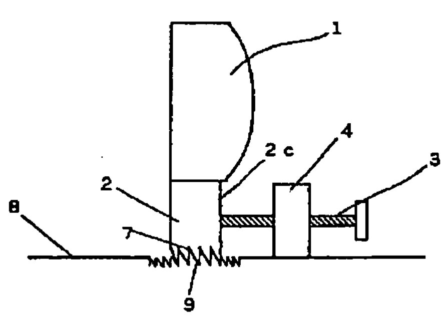
[Drawing 1]
【図1】



[Drawing 2]
【図2】

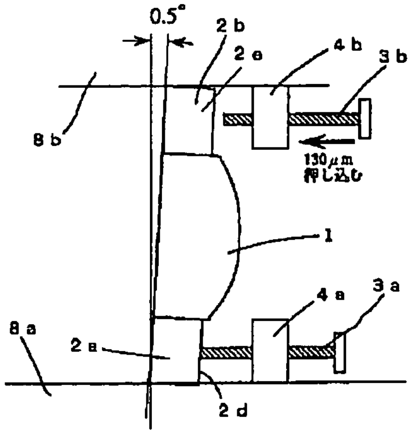


[Drawing 3]
【図3】

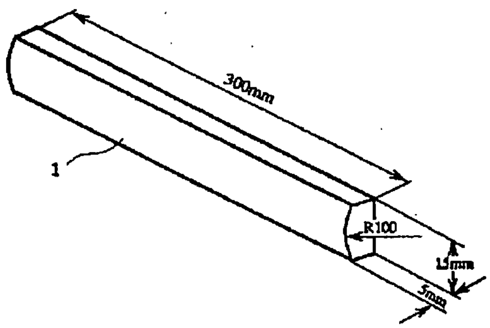


[Drawing 4]

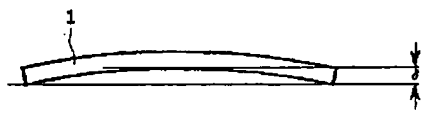
【図4】



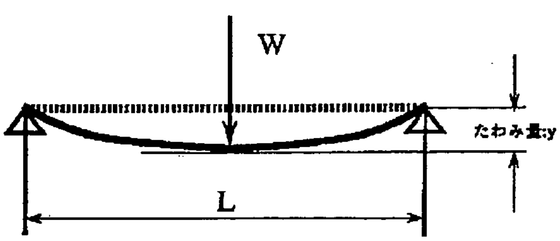
[Drawing 5]
【図5】



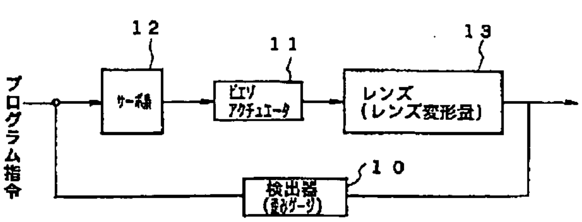
[Drawing 6]
【図6】



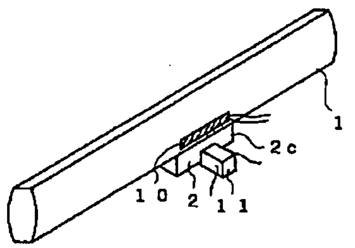
[Drawing 7]
【図7】



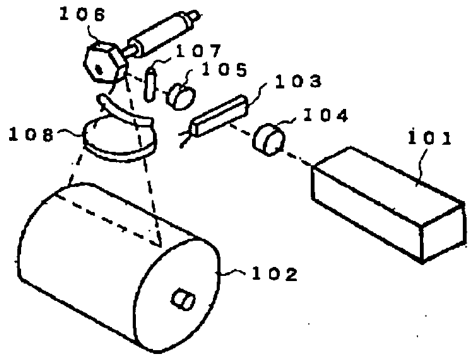
[Drawing 8]
【図8】



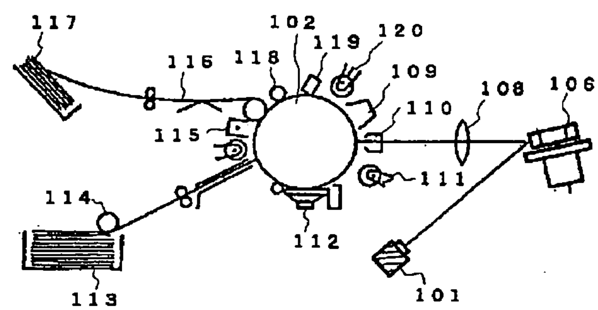
[Drawing 9]
【図9】



[Drawing 10]
【図10】



[Drawing 11]
【図11】



[Translation done.]